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Unit weight

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DEPARTMENT OF CIVIL ENGINEERING
AALBORG UNIVERSITY

Unit weight

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DCE Lecture Notes No. 68

Unit weight

by

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Preface

This guide deals with the determination of the unit weight of fine grained soil.

The guide is part of a series, which explain the execution of geotechnical classification experiments as carried out at the Geotechnical Engineering Laboratory.

The guide is constructed as follows:

- *Appertaining standards*
- *Definitions*
- *Apparatus*
- *Equipment calibration*
- *Preparing the test sample*
- *Procedure for experiment*
- *Calculation*
- *Reporting*
- *Remarks*
- *Schema for experiment execution*
- *Appendix, if any*

It is recommended that the user of this guide reads the entire guide before the experiment is started.

Numbering of figures in the text is indicated by { }.

Units are indicated by [], e.g. [%].



Appertaining standard

The experiment is based on and further described in the standard DS/CEN ISO/TS 17892-2.

Definition

The unit weight of a soil γ (specific load) is force per volume unit:

$$\gamma = \rho \cdot g \quad [\text{kN/m}^3]$$

ρ Density of the soil [g/cm^3]

g gravitational acceleration = 9,8 [m/sek^2]

The unit weight determined with measuring and weighing of undisturbed, intact samples.

The unit weight of a soil is normally to be found in the interval 15 - 23 kN/m^3 .

For soil with large water content, it can be as low as a little over 10 kN/m^3 , and for soil sorts with very small void ratio; up to 25 kN/m^3 .

Apparatus

Apparatus used in the experiment. Numbers refer to figure 1.

- Intact soil sample in sample tube {1}
- Scale, weighing accuracy 0,1g
- Cutting and trimming tools {2}
- Measuring tape {3}
- Vernier calliper {4}
- Sample extractor {5}

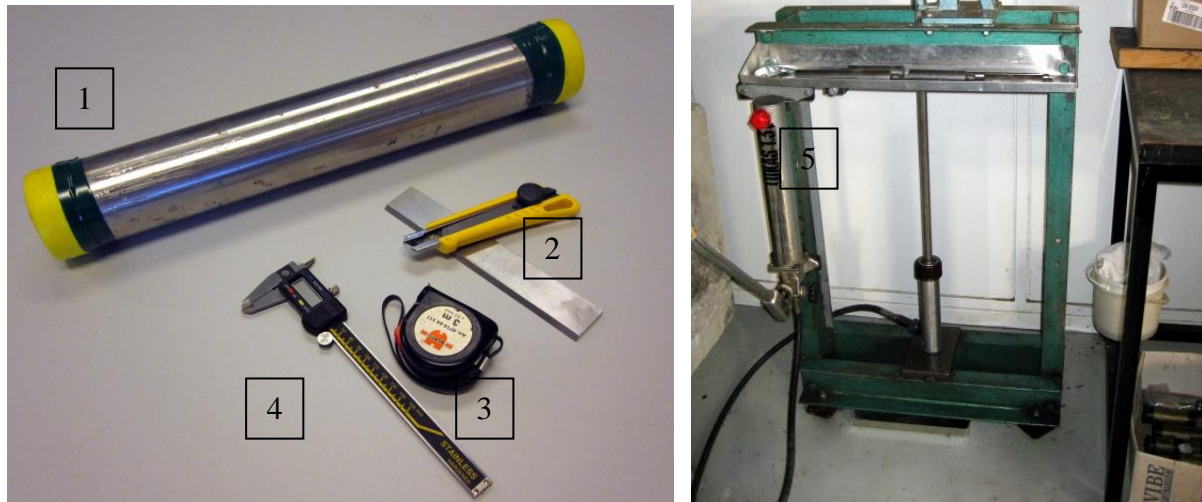


Figure 1: Apparatus for experiment.

Equipment calibration

No equipment needs calibrating.

Preparing test sample

The test sample needs no preparation before experiment.

Procedure for experiment

Method I

The sample tube is brushed clean of exterior soil remnants and dried off thoroughly.

- The undisturbed sample tube is opened and filling bags, wax or other materials used for sealing the cylinder is removed.
- The soil sample remains untouched in the cylinder.
- The brushed cylinder with a soil sample is weighed, ($Cyl + W$).
- The height of the soil sample is measured, (H). Measure the height of the cylinder and deduct the height of the empty space in the cylinder if this is not filled, figure 2.
- The soil sample is pressed out with the sample extractor.
- The cylinder is washed and dried thoroughly
- The cylinder is weighed, (Cyl).
- The internal diameter of the cylinder is measured (D), figure 3.

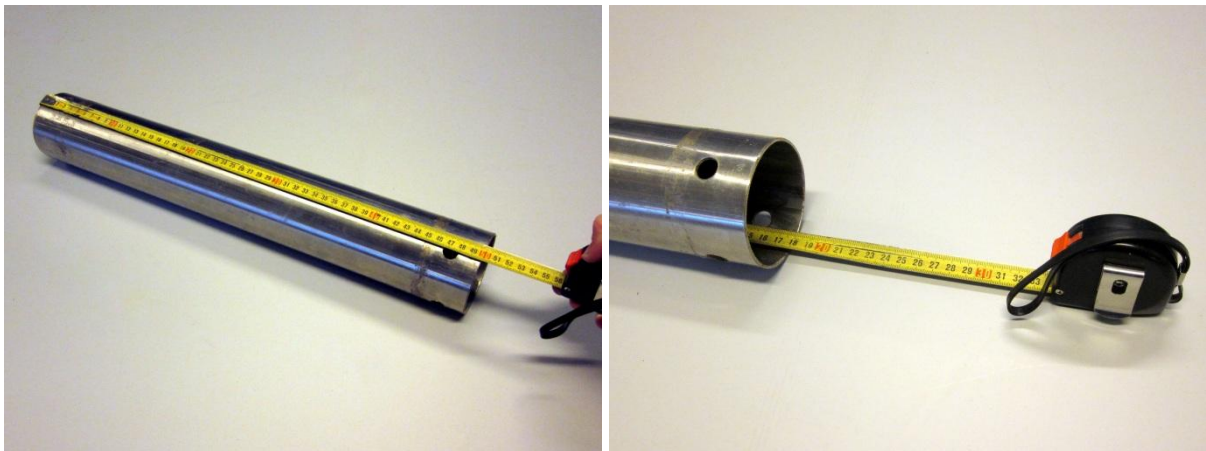


Figure 2: Measurements of cylinder and the empty space in the cylinder, respectively.

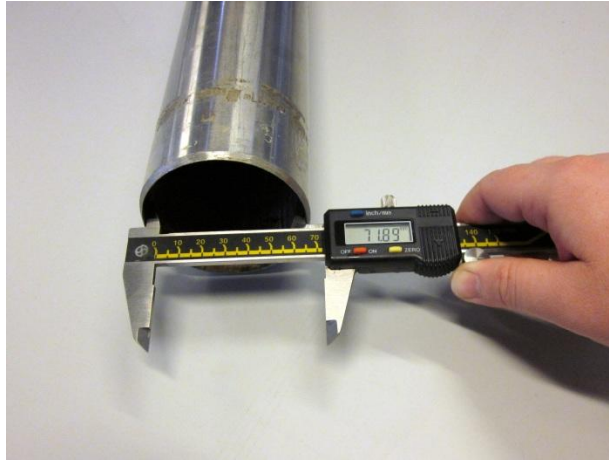


Figure 3: The internal diameter is measured with a vernier calliper.

Method II

After the cylinder has been opened, the soil sample is pressed out with the sample extractor and the ends are shaped levelled.

- A small part of the soil sample is hereafter pressed down in a volume weight cylinder with known weight (C_{yl}) and internal volume (V).
- The soil sample is trimmed along the end plates of the volume weight cylinder.
- The volume weight cylinder with a soil sample is weighed ($C_{yl} + W$).

Calculations

Weight of soil sample (W):

$$W = (Cyl + W) - Cyl$$

Volume of soil sample (V):

$$V = \frac{\pi}{4} \cdot D^2 \cdot H$$

Volume weight of the soil can be calculated with:

$$\gamma = \frac{W}{V} \cdot g [kN/m^3]$$

Reporting

State which method has been used.

Volume weight is indicated by 1 decimal.

Remarks

Shaping of soil sample must be done so evaporation is minimized. This can be ensured by, first of all, conducting the experiment in a cooled room and making sure the executing of the experiment is done quickly.

It is important that intact tube samples are sufficiently sealed and kept cooled until they are used. A storage temperature of 8 – 10°C is recommended.

Method I is usually used with intact tube samples.

If it is layered soil, method II is used, and the volume weight is determined for each layer.

Unit weight

Case			Case no.
Examined	to	Lab. no.	Boring no.
Controlled d.	Approved d	Level	Appendix no.

Used method: ____I ____II

UNIT WEIGHT

Sample	No					
Cylinder	No					
Cyl. + W	g					
Cyl.	g					
Sample weight W	g					
Tube length	cm					
Empty space length	cm					
Sample length	cm					
Sample diameter	cm					
Sample volume V	cm ³					
$\rho = \frac{W}{V}$	g/cm ³					
$\gamma = \frac{W}{V} \cdot g$	kN/m ³					

